Scientists develop novel system that recovers energy normally lost in industrial processes

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Each year, energy that equates to billions of barrels of oil is wasted as heat lost from machines and industrial processes. Recovering this energy could reduce energy costs. Scientists from Australia and Malaysia have developed a novel system that is designed to maximize such recovery.

Heat can be converted to electricity by devices called thermoelectric power generators (TEGs), which are made of thermoelectric materials that generate electricity when heat passes through them. Previous studies have attempted to use TEGs to recover energy from the heat generated by, for example, car engines, woodstoves and refrigerators. However, TEGs can only convert a small amount of the heat supplied to them, and the rest is emitted as heat from their "cold" side. No previous studies have attempted to recover energy from the waste heat that has already passed through TEGs. Researchers from Malaysia's Universiti Teknologi MARA and RMIT University in Australia set out to develop a system that can do this.

The researchers designed a novel system in which a TEG was sandwiched between two heat pipes, which are devices that can efficiently transfer heat. One pipe delivered heat to the TEG and the other collected heat emitted from the other side.

The team built a small-scale version of their system to test in the lab before larger scale versions are made for real-world applications. In this test system, the energy source was not heat wasted by machinery, but an electrical heater. Using a controlled heat source in this way ensured that the researchers knew how much energy entered the system. The supplied heat was transferred to eight TEGs via heat pipes. The researchers measured the amount of electricity produced by the TEGs and the amount of energy recovered from their cold side.

When two kilowatts of energy were supplied under normal circumstances to the novel system, they recovered approximately 1.35 kilowatts of heat: over 67% of the energy supplied. In addition, the TEGs generated 10.39 watts of electricity during the heat recovery process.

Both heat pipes and TEGs are passive devices that

require no energy input besides the waste energy, and the findings demonstrate that these simple devices can be used to generate electricity and make energy recovery more efficient. The work could provide the basis for future development of larger scale energy recovery systems.

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